Small Business Innovation Research/Small Business Tech Transfer

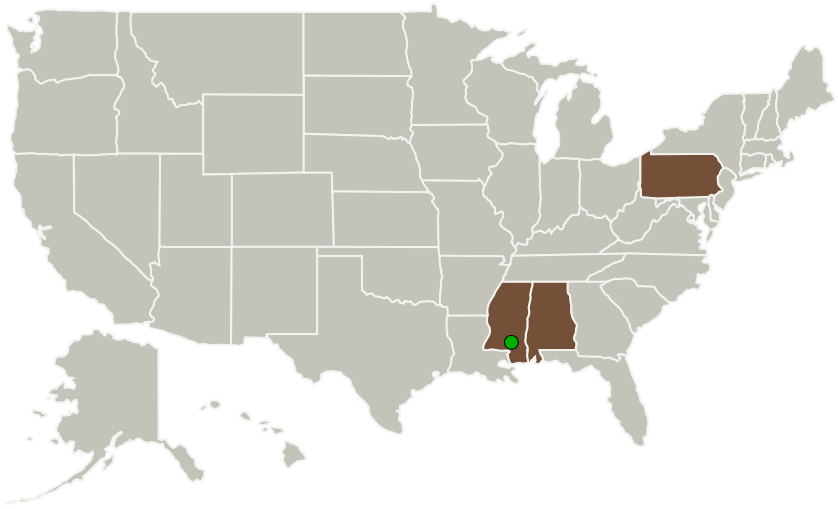
Novel Design of Orifice Type Control Element for Mitigating Instabilities, Phase II

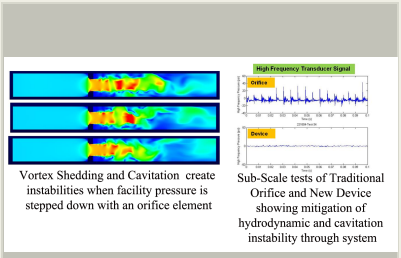
Completed Technology Project (2012 - 2014)

Project Introduction

An orifice element is commonly used in liquid rocket engine test facilities to provide a large reduction in pressure over a very small distance in the piping system. Orifice elements are used in propellant lines, feed systems, plume suppression systems and steam ejector trains. While the orifice as a device is largely effective in stepping down pressure, it is also susceptible to a wake-vortex type instability and cavitation instability that propagate downstream and interact with other elements of the test facility resulting in structural vibration. In this proposal a new proprietary instability mitigation device has been developed that steps down the pressure, straightens the flow and suppresses all instability modes. The device is scalable and can be used for different mass flow rates and varying levels of de-pressurization conditions. It is relatively inexpensive to manufacture, easy to fabricate and install, and can be tailored to meet the performance requirements of a given facility. In Phase I, the device has been successfully demonstrated in a sub-scale cryogenic test facility. In Phase II the performance of the device will be calibrated for full-scale operation in a cryogenic test facility and a water test facility.

Primary U.S. Work Locations and Key Partners





Novel Design of Orifice Type Control Element for Mitigating Instabilities

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Organizations Performing Work	Role	Type	Location
CRAFT Tech - Combustion Research and Flow Technology	Lead Organization	Industry	Pipersville, Pennsylvania
Stennis Space Center(SSC)	Supporting Organization	NASA Center	Stennis Space Center, Mississippi
University of Alabama in Huntsville(UAH)	Supporting Organization	Academia	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Mississippi
Pennsylvania	

Project Transitions

June 2012: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137303)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

CRAFT Tech - Combustion Research and Flow Technology

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Vineet Ahuja

Co-Investigator:

Vineet Ahuja

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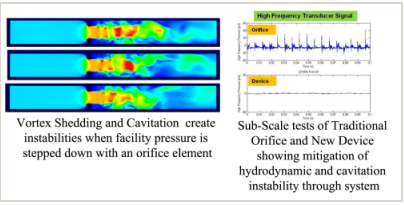
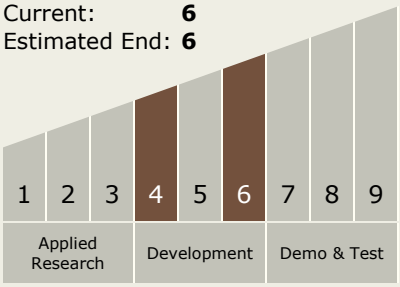
Images



Project Image
Novel Design of Orifice Type Control Element for Mitigating Instabilities
(https://techport.nasa.gov/image/132196)

Technology Maturity (TRL)

Start: **4**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX13 Ground, Test, and Surface Systems
  - TX13.2 Test and Qualification
    - TX13.2.1 Mechanical/Structural Integrity Testing

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System